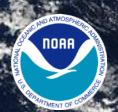
Updates to NHC Products, Services, and Warnings

Daniel Brown National Hurricane Center 23 May 2017

#NOAAHurricaneAware

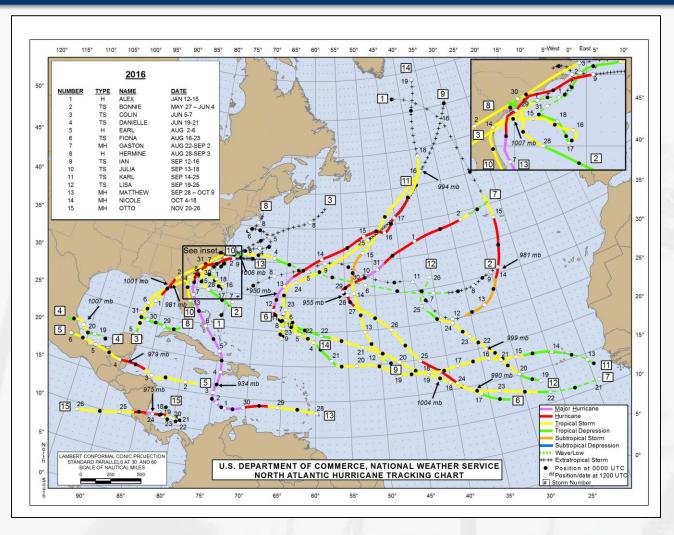




2016 Atlantic Hurricane Season

First Above Average Season Since 2012





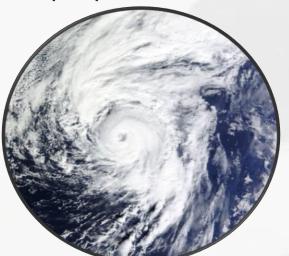
15 named storms, 7 hurricanes, and 4 major hurricanes

Forecast Challenges 2016

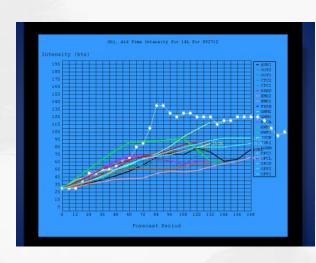
Track, Intensity, and Genesis



Hurricane in January (Alex)



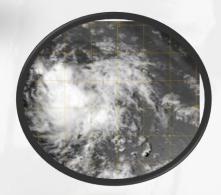
Rapid intensification



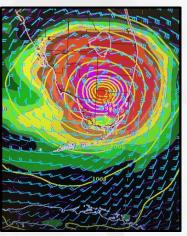
Complex Tracks



Forecasting Tropical Cyclone Development



AL99 (Pre-Hermine)

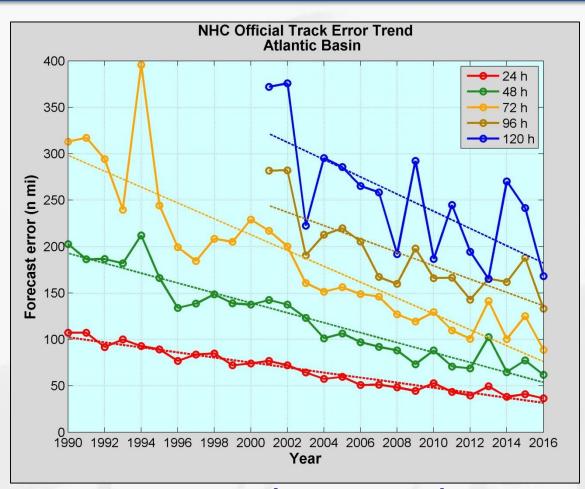


False Alarms

Atlantic Track Verification 2016

Several Records Set





NHC Track Error Trend

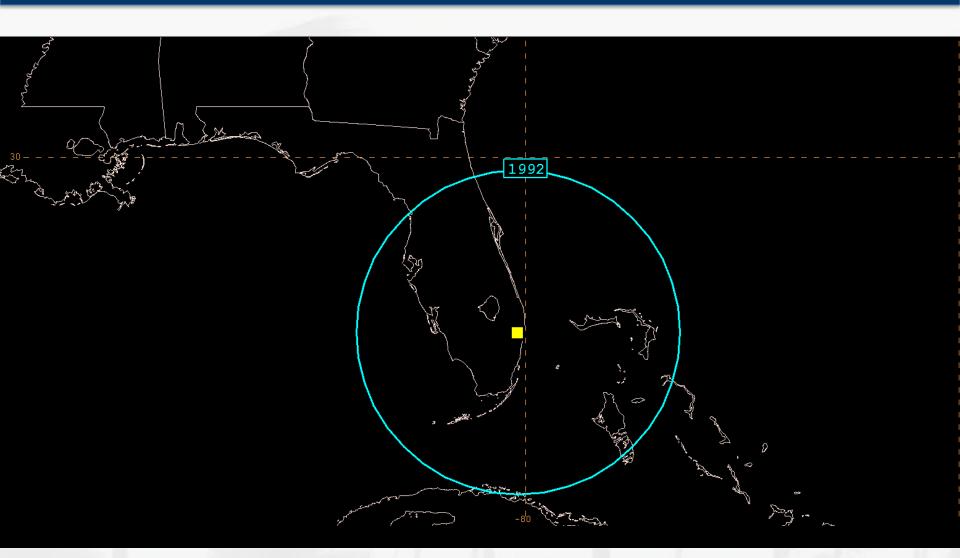
2016 NHC Forecast Errors

VT (h)	NT	TRACK (n mi)	INT (kt)
=====		======	======
000	386	7.3	2.2
012	354	24.3	5.4
024	322	36.5	7.6
036	290	47.7	9.4
048	258	61.8	10.6
072	204	88.8	11.7
096	161	133.1	14.7
120	131	168.2	16.1

Values in blue exceed all-time records.

Track Forecast Improvements Tremendous Improvements Since 1992

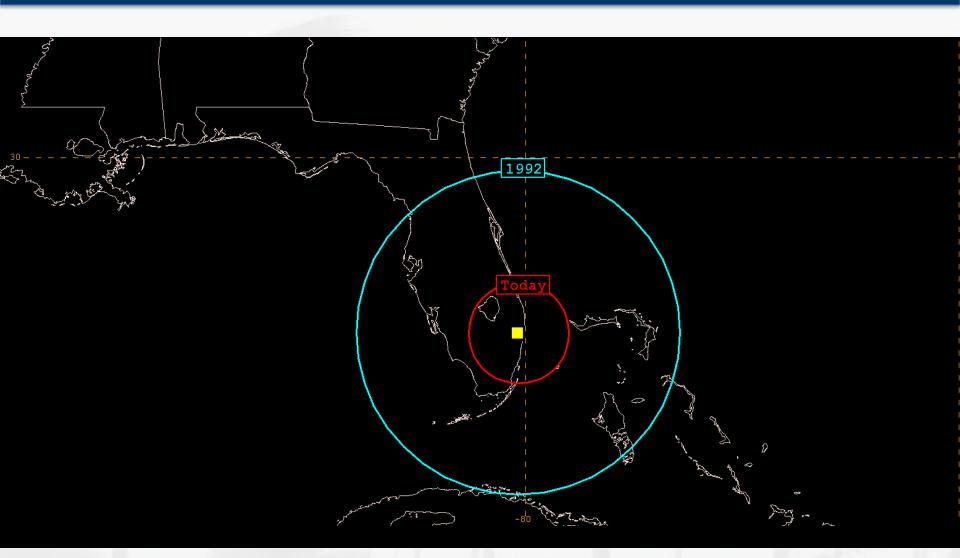




Average 3-day NHC Track Error

Track Forecast Improvements Tremendous Improvements Since 1992

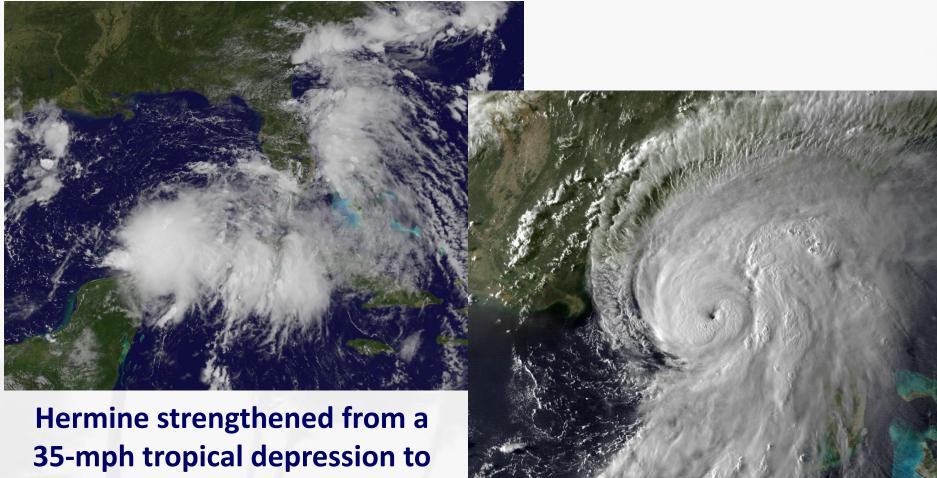




Average 3-day NHC Track Error

Hermine's Intensification Tropical Depression to Hurricane



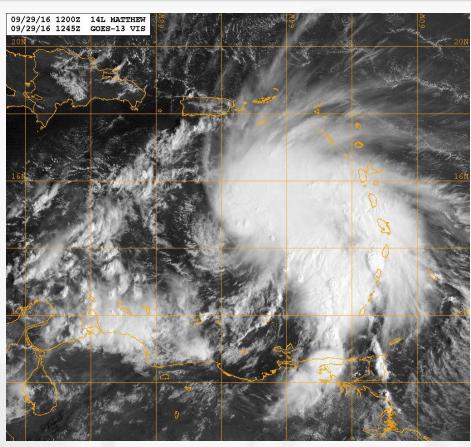


Hermine strengthened from a 35-mph tropical depression to a 80 mph hurricane in a little more than 48 hours.

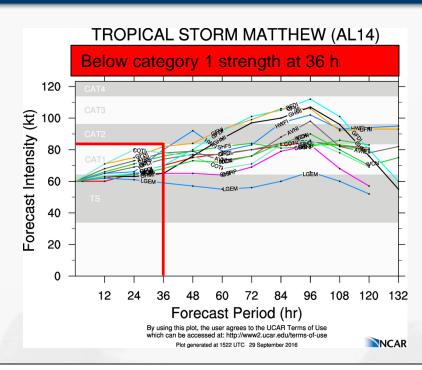
Predicting Rapid Intensification

Still a Difficult Task





Tropical Storm Matthew – 70 mph 8:00 am September 29



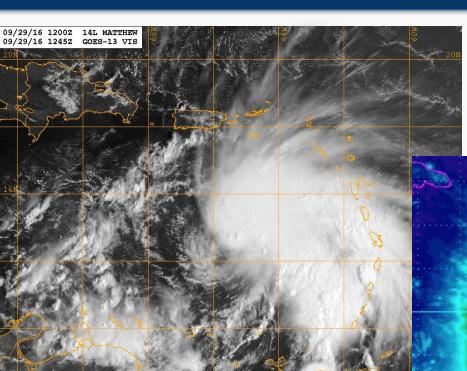
NHC Discussion 11 am Thursday, September 29, 2016

The center of Matthew is exposed to the southwest of the deep convection due to moderate southwesterly shear. Given the current shear and structure of Matthew, only slight strengthening is predicted during the next 24 hours.

Forecaster Brown

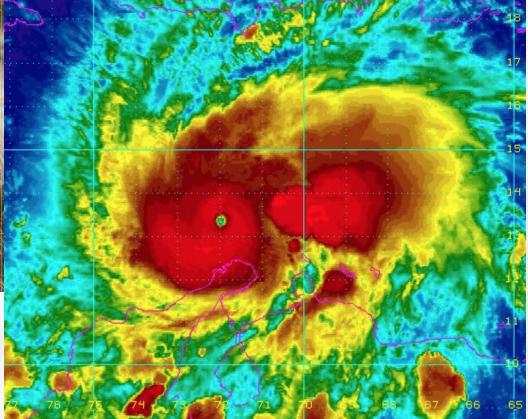
Predicting Rapid Intensification Still a Difficult Task





Tropical Storm Matthew – 70 mph 8:00 am September 29

36 hours later
Hurricane Matthew
Category 5 – 165 mph



NATIONAL HURRICANE CENTER 2017 Product Updates

NHC Product Updates Storm Surge

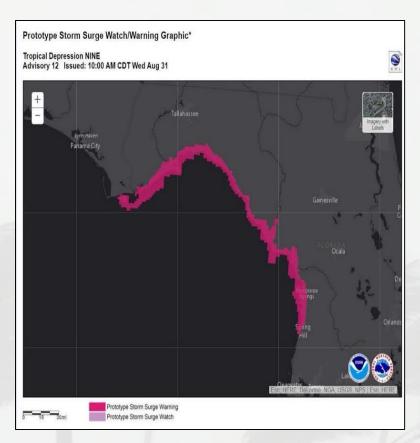


STORM SURGE WATCH/WARNING

Operational in 2017

AVAILABILITY:

- Graphic on NHC website
- Watch/Warning section of the NHC Public Advisory
- NWS WFO Hurricane Local Statements
- EAS Activation



Storm Surge Watch/Warning Definitions



STORM SURGE WARNING

There is a danger of life-threatening inundation from rising water moving inland from the shoreline somewhere within the specified area, generally within 36 hours.

STORM SURGE WATCH

There is the **possibility** of life-threatening inundation from rising water moving inland from the shoreline somewhere within the specified area, generally within **48 hours**.

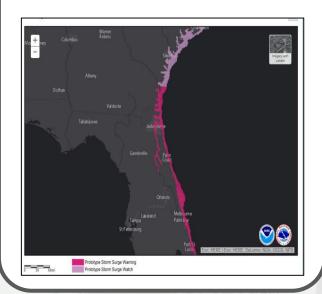
Storm Surge Updates

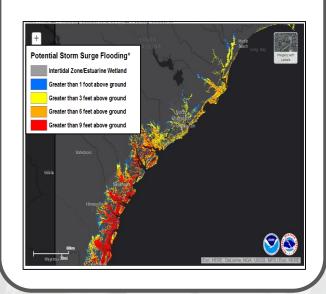
Warning vs. Potential Flooding Map



STORM SURGE WATCH/WARNING

POTENTIAL STORM SURGE FLOODING MAP





Storm Surge Updates Warning vs. Potential Flooding Map



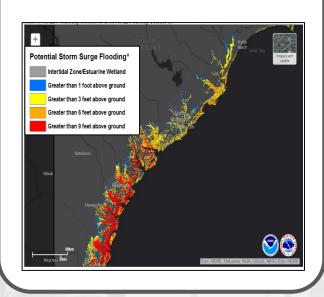
STORM SURGE WATCH/WARNING

General Public



POTENTIAL STORM SURGE FLOODING MAP

Decision Makers



Storm Surge Updates Warning vs. Potential Flooding Map



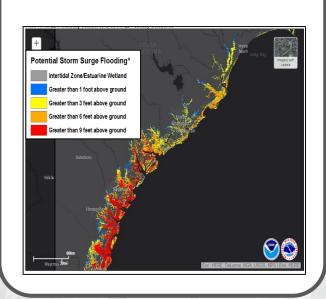
STORM SURGE WATCH/WARNING

General Public Subjective



POTENTIAL STORM SURGE FLOODING MAP

Decision Makers
Objective



Storm Surge Updates

Warning vs. Potential Flooding Map



STORM SURGE WATCH/WARNING

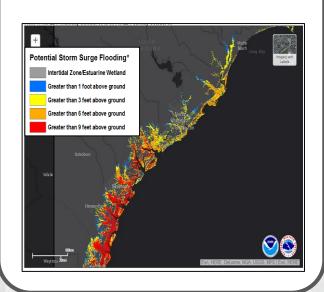
General Public
Subjective
Categorical
(life threatening inundation)



POTENTIAL STORM SURGE FLOODING MAP

Decision Makers Objective

Quantitative guidance



Storm Surge Updates

Warning vs. Potential Flooding Map



STORM SURGE WATCH/WARNING

General Public
Subjective
Categorical
(life threatening inundation)

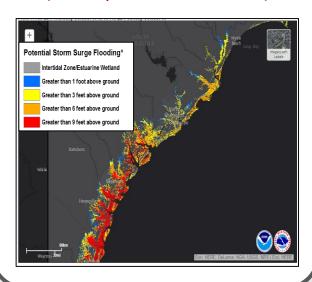


POTENTIAL STORM SURGE FLOODING MAP

Decision Makers Objective

Quantitative guidance

Reasonable worst-case scenario at a location (not expected inundation)



Potential Tropical Cyclone Advisories



BEFORE A CYCLONE FORMS

The NHC can issue advisories, watches, and warnings for tropical disturbances

 A threat of bringing tropical storm or hurricane conditions to land within 48 hours.

WATCH/WARNING

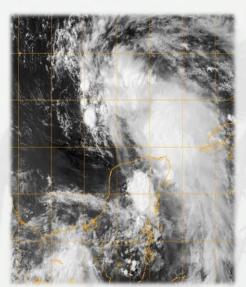
Regular TS/Hurricane watch and warning criteria applies

- Watch conditions possible within 48 h
- Warning conditions expected within 36 h

WHAT DO WE CALL IT

Systems would be identified as **Potential Tropical Cyclones** with the same numbering system as depressions – "One", "Two", etc.





Potential Tropical Cyclone Advisories



STANDARD NHC ADVISORY PRODUCTS

Available at standard advisory times

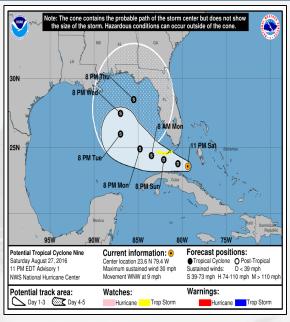
- Public Advisory
- Forecast Advisory
- Discussion
- Wind Speed Probabilities
- Cone graphic
- Storm Surge products, as needed

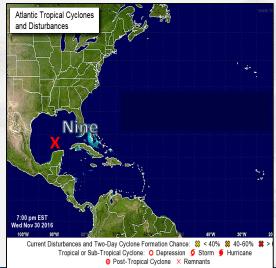
GENESIS PROBABILITIES

Genesis probabilities will appear in both the Tropical Weather Outlook and the Public Advisory

GRAPHICAL TROPICAL OUTLOOK

The Graphical Tropical Outlook will **no longer display a formation area** for these systems, to avoid confusion with the (now available) 5-day track forecast and cone graphic





Potential Tropical Cyclone Advisories

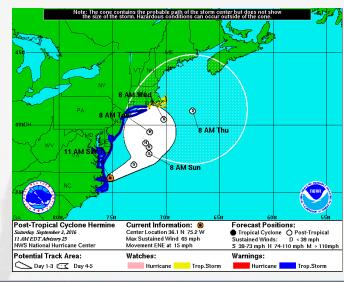


ISSUANCE CONSIDERATIONS

Not directly tied to tropical cyclone formation chance.

INITIAL ISSUANCE CRITERIA INCLUDE:

- Likely impacts
- Need for tropical cyclone watches and warnings
- Desire to avoid switching warning types (tropical vs. non-tropical)





Potential Tropical Cyclone Advisories



MESSAGING CONSIDERATIONS:

- Issued only for systems threatening land within the watch/warning time frame.
- Advisory packages will be discontinued when watches and warnings are no longer necessary.
- When the threat is not imminent this could result in gaps in product issuance.





POTENTIAL TROPICAL CYCLONE ONE PUBLIC ADVISORY NUMBER 1
NWS NATIONAL HURRICANE CENTER MIAMI FL AL012016
400 PM CDT WED JUN 5 2016

...TROPICAL DISTURBANCE OVER THE EAST-CENTRAL GULF OF MEXICO EXPECTED TO BECOME A TROPICAL STORM...

...TROPICAL STORM WARNING ISSUED FOR PORTIONS OF THE WEST COAST OF FLORIDA...

SUMMARY OF 400 PM CDT...2100 UTC...INFORMATION

LOCATION...25.3N 86.5W

ABOUT 310 MI...500 KM SW OF TAMPA

ABOUT 320 MI...510 KM SSW OF APALACHICOLA FLORIDA

MAXIMUM SUSTAINED WINDS...35 MPH...55 KM/H

PRESENT MOVEMENT...N OR 360 DEGREES AT 3 MPH...6 KM/H

MINIMUM CENTRAL PRESSURE...1010 MB...29.92 INCHES

WATCHES AND WARNINGS

CHANGES WITH THIS ADVISORY ...

A Tropical Storm Warning has been issued fro the west coast of Florida from Boca Grande to Ochlockonee River.

SUMMARY OF WATCHES AND WARNINGS IN EFFECT...

- A Tropical Storm Warning is in effect for...
- * The west coast of Florida from Boca Grande to Ochlocknee River
- A Tropical Storm Warning means that tropical storm conditions are expected somewhere within the warning

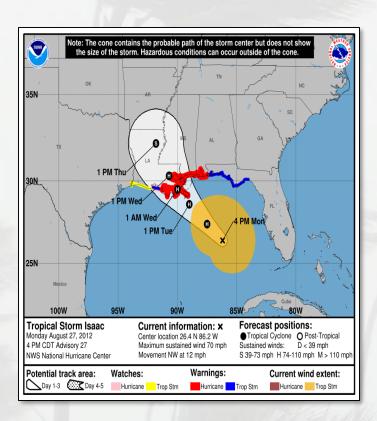
Graphics

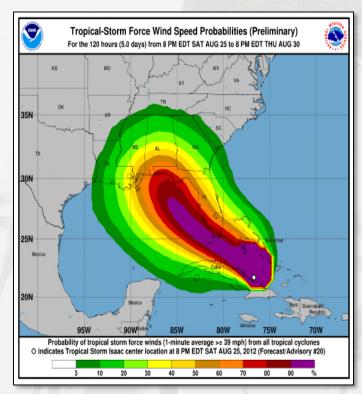


UPDATE TO NHC GRAPHICAL PRODUCTS

Consistent background maps with a 'cleaner' look and feel

- Storm size (initial wind field) displayed on the error cone
 - reinforcing hazardous conditions occur outside the cone.





Time of Arrival

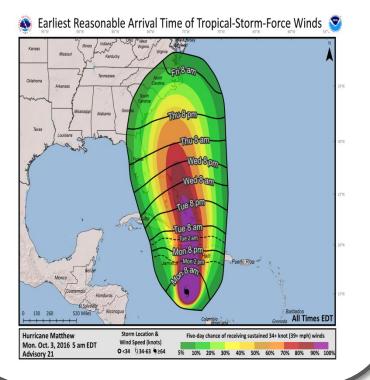


EXPERIMENTAL TIME OF ARRIVAL GRAPHIC

Accounts for forecast uncertainty (track/intensity/size)

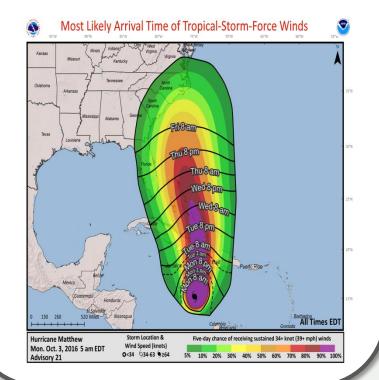
'EARLIEST REASONABLE' ARRIVAL TIME

- No more than a 10% chance of onset
- Most conservative / Risk-averse



'MOST LIKELY' ARRIVAL TIME

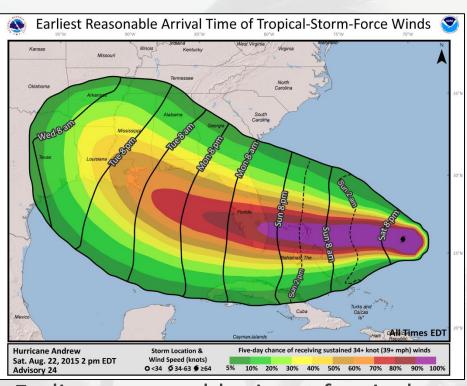
Equally likely to occur before as after



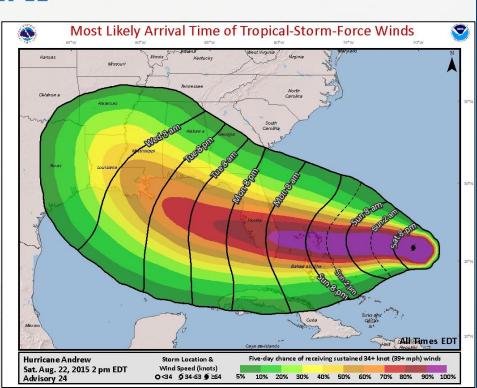
Time of Arrival



HURRICANE ANDREW TIMING EXAMPLE



Earliest reasonable time of arrival around midnight Sunday night/Monday morning



Mostly likely time of arrival just before daybreak Monday

Enhanced Messaging NHC Key Messages





Key Messages regarding Hurricane Matthew October 4, 2016 – 5 p.m. EDT



- Matthew is likely to produce devastating impacts from storm surge, extreme winds, heavy rains, flash floods, and/or mudslides in portions of the warning areas in Haiti, Cuba, and the Bahamas. Please consult statements from the meteorological services and other government officials in those countries.
- 2. When a hurricane is forecast to take a track roughly parallel to a coastline, as Matthew is forecast to go from Florida through South Carolina, it becomes very difficult to estimate impacts this far in advance. For example, only a small deviation of the track to the left of the NHC forecast could bring the core of a major hurricane onshore, while a small deviation to the right could keep all of the hurricane-force winds offshore. It will likely take another day or so for the potential impacts of Matthew in the United States to clarify.
- 3. Tropical storm or hurricane conditions could affect portions of Florida north of the current Hurricane Watch area, Georgia, South Carolina, and North Carolina later this week or this weekend, even if the center of Matthew remains offshore. It is too soon to specify what, if any, direct impacts Matthew might have on the remainder of the U.S. east coast farther to the north. At a minimum, very dangerous beach and boating conditions are likely along much of the U.S. east coast later this week and weekend.





NOAA National Hurricane Center: www.hurricanes.gov

Enhanced MessagingSpecial Tweets/Messages





An example of special messages that are posted to the NHC website and Twitter simultaneously to indicate when advisories will be initiated.

Online Training COMET Modules



Storm surge and tropical cyclone related COMET modules online:

- Introduction to Tropical Cyclone Storm Surge
- Storm Surge and Datums
- Forecasting Tropical Cyclone Storm Surge
- Determining the Onset and Risk of Tropical Cyclone Winds
- Tropical Cyclone Forecast Uncertainty
- Real-Time Storm Surge Products
- Best Practices in Tropical Cyclone Briefings



Use of Probabilistic Surge Guidance in Local Storm Surge Forecasting

Languages: English Publish Date: 2015-07-20

Skill Level: 6 Completion Time: .75 - 1.00 h
Topics:

Tropical/Hurricanes
(0 reviews)



Determining the Onset and Risk of Tropical Cyclone Winds

Languages: English Publish Date: 2015-07-01

Skill Level: Completion Time: .50 - .75 h

Topics: Tropical/Hurricanes

(0 reviews)

www.meted.ucar.edu

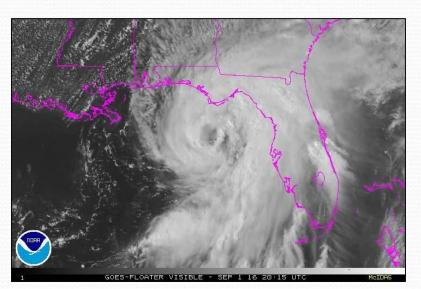
Spanish-Language Website FIU Partnership

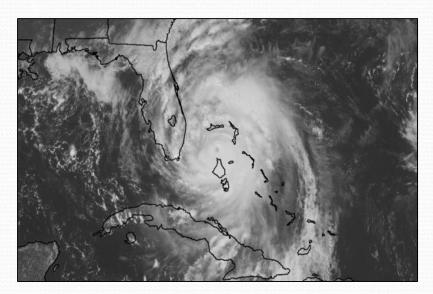




huracanes.fiu.edu

NWS Local Products and Decision Support in a Tropical Cyclone Emergency





Matt Moreland
NOAA Hurricane Webinar Series
May 23, 2017

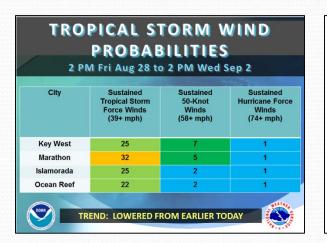
Credit to: D. Sharp, S. Spratt, A. Devanas, J. McNatt, W. Ulrich, M. Green, A. Sandrik

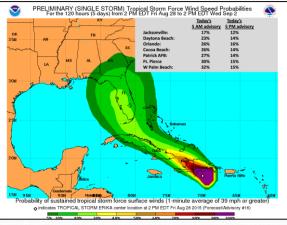


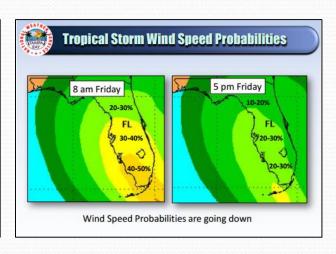


Different Partners – Different Formats

Consistent Data









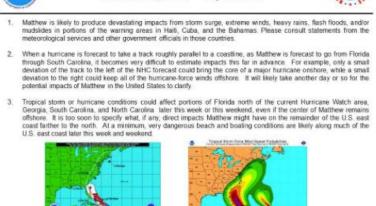






Social Media





NOAA National Hurricane Center: www.hurricanes.gov



Plan where your family would ride out the storm if told to evacuate!

ready.gov/evacuating-you...

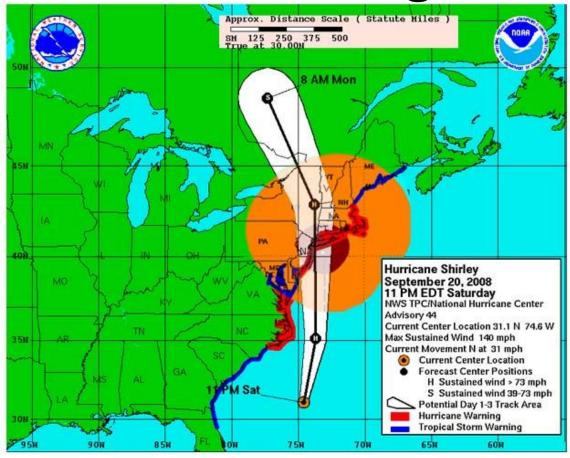
#HurricanePrep #jaxready #jaxwx #flwx #gawx







Cone is a Great Briefing Tool...but

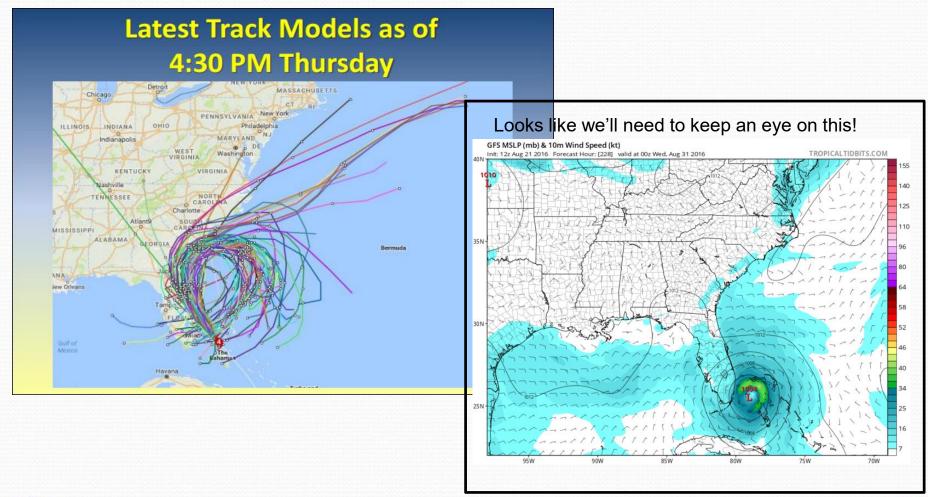




Does Not Provide Information About Impacts!!!!



We Avoid Spaghetti Plots and Single Model Runs

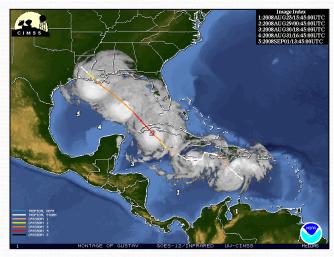






We Avoid Using Analogs

Every storm is different, but people have a natural tendency to draw from personal experience. This is particularly dangerous relative to storm surge.



Hurricane Gustav (2008):

"Stronger" at landfall (Cat 2)

Relatively low flooding impacts

Significant wind damage



Hurricane Isaac (2012):
Similar track/size to Gustav
"Weaker" at landfall (Cat 1)
Major flooding impacts
Low end wind damage

Pre-Tropical Cyclone Development

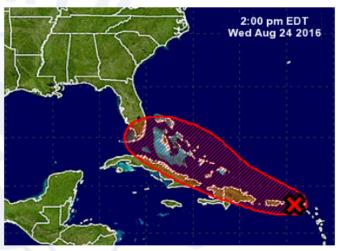
Example from 2016 Season



Possible Development Areas



- Currently the system is in a hostile environment which is inhibiting development.
- Over the next few days the system will move into a more favorable area for development, likely over the Bahamas.
- Over the next 5 days there is an 80% chance of the system developing.
- The red ellipse only shows were the storm could develop into a tropical depression, NOT it's path after development occurs.



Trapical Cyclone Formation Potential for the Five-Day Pariod Ending at 2:00 pm EDT Mon Aug 28:2016
Chance of Cyclone Formation in Five Days: □ Low < 40% ■ Medium 40-36% ■ Thip > 80%
X indicates current disturbance location; shading indicates potential formation area.

Residents and interests in north Florida and southeast Georgia should closely monitor the future progress of the storm. Be careful about rumors and social media posts, At this time the storm poses no immediate threat to the region.

1









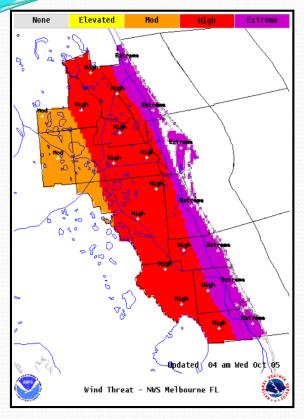
US National Weather Service Jacksonville





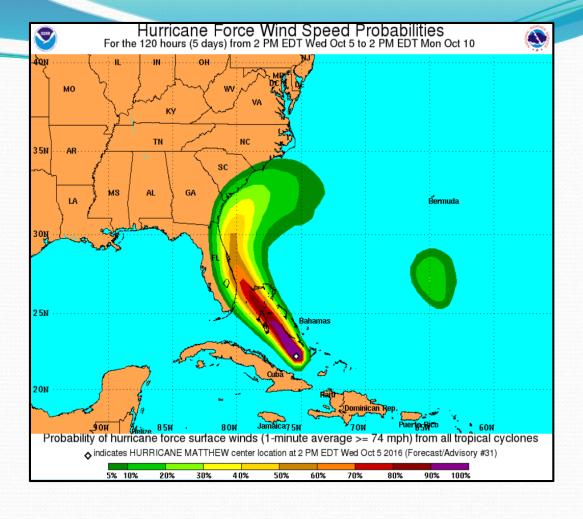


To be Safe, Prepare for This





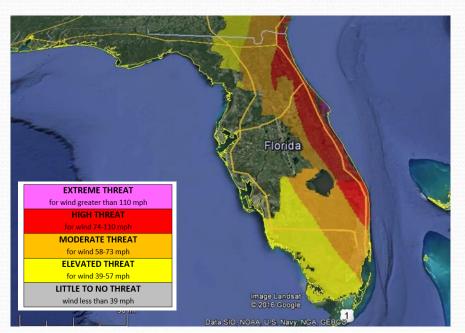




Extreme Wind Threat:

- Most locations along the ECFL coast have a similar chance to receive hurricane force winds
- The best chance for major hurricane force winds is east of I-95, especially for the barrier islands and Cape Canaveral

Wind Hazard











Tornado Impact

Forecast: Friday-Friday Night

SPC Outlook - Valid Friday



What:

- For very quick spin up tornadoes within the feeder bands
- Tornado threat diminishes as the center passes
- Areas North and East of the center most at risk (Mostly Friday AM)

Primary Threats:

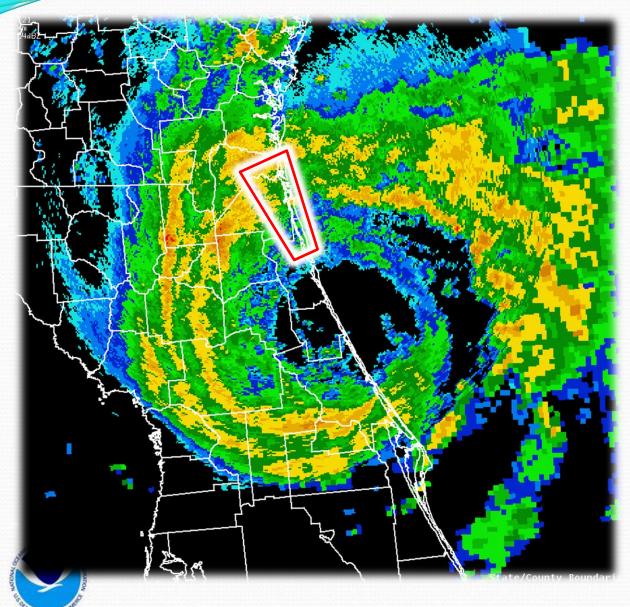
- Brief tornados (typically in the EF0 to EF1 range, but cannot rule out EF2)
- Storms will be moving to the West or Northwest (not typical storm direction)
- Any storms will be moving fast and spin up quickly...very little lead times usually associated with them

Will include 2-3 major threat and impact statements here
 (widespread power outages, etc)





Extreme Wind Warning



- Warning issued when there is an imminent threat to life & property.
- Those within the warning area need to seek safest shelter within shelter immediately.

Extreme Wind Warning:

- a. Tropical cyclone is a category3 or greater <u>AND</u>
- Sustained tropical cyclone surface winds of 100 knots (115 mph) or greater are occurring or are expected to occur within one hour.
- Valid time 2 hrs or less



Hurricane Local Statement

- Non-segmented, Land only product
- Broadcasts on NWR All Hazards – NOAA Weather Radio
- Overview of tropical impacts across CWA
 - Like a Hazardous Weather Outlook for Tropical Impacts

HURRICANE WILMA LOCAL STATEMENT ADVISORY NUMBER 32 NATIONAL WEATHER SERVICE MIAMI FL AL242005 533 AM EDT SUN OCT 23 2005

THIS PRODUCT COVERS SOUTH FLORIDA

EXTENSIVE TO DEVASTATING DAMAGE AND LIFE-THREATENING CONDITIONS EXPECTED AS HURRICANE WILMA MOVES NORTHEAST ACROSS SOUTH FLORIDA

NEW INFORMATION

- * CHANGES TO WATCHES AND WARNINGS:
 - A HURRICANE WATCH HAS BEEN UPGRADED TO A HURRICANE WARNING FOR GLADES...HENDRY...PALM BEACH...COLLIER...BROWARD...MIAMI-DADE AND MAINLAND MONROE COUNTIES
- * CURRENT WATCHES AND WARNINGS:
 - A HURRICANE WARNING IS IN EFFECT FOR GLADES...HENDRY...PALM BEACH...COLLIER...BROWARD...MIAMI-DADE AND MAINLAND MONROE COUNTIES
- * STORM INFORMATION:
 - ABOUT 480 MILES WEST-SOUTHWEST OF MIAMI FL OR ABOUT 410 MILES SOUTHWEST OF NAPLES FL
 - 22.1N 86.6W
 - STORM INTENSITY 100 MPH
 - MOVING NORTH OR 360 DEGREES AT 3 MPH

SITUATION OVERVIEW

EXTREMELY DANGEROUS HURRICANE WILMA IS FORECAST TO IMPACT SOUTH FLORIDA BEGINNING THIS EVENING. THE MAIN CONCERN IS FOR LIFE-THREATENING INUNDATION IN SURGE-PRONE AREAS OF COLLIER AND MAINLAND MONROE COUNTIES WHERE THERE IS A SUBSTANTIAL RISK OF DEVASTATING IMPACTS SOMETIME BETWEEN EARLY MONDAY MORNING AND MONDAY EVENING. ADDITIONALLY, THERE IS A RISK FOR DEVASTATING DAMAGE FROM WIND ACROSS MAINLAND SOUTH FLORIDA PARTICULARLY DURING LAYLIGHT HOURS MONDAY AS WILMA CROSSES THE PENINSULA.

THERE ARE ALSO CONCERNS WITH SIGNIFICANT IMPACTS FROM FLOODING RAINS AS THE HURRICANE MOVES ACROSS THE AREA LATE SUNDAY AND MONDAY.

ISOLATED TO SCATTERED TORNADOES CAPABLE OF INFLICTING LIMITED TO LOCALLY SIGNIFICANT DAMAGE ARE ALSO POSSIBLE STARTING THIS AFTERNOON AS OUTER RAIN BANDS BEGIN TO IMPACT SOUTH FLORIDA. AS YOU WORK OUTSIDE COMPLETING YOUR PREPARATIONS, STAY TUNED TO THE LATEST IN FORMATION IN CASE TORNADO WARNINGS BECOME NECESSARY.

SEVERAL COUNTIES HAVE MANDATORY EVACUATION ORDERS IN PLACE. CHECK WITH
YOUR LOCAL COUNTY OFFICIALS FOR ORDERS WHICH MAY A FECT YOU.



Hurricane Local Statement

- Affected Area
- Headline/Primary Message
- New Information
 - Since last storm update
- Overview of Situation
 - Generalized Threat Assessment
 - Summary for WFO's area of responsibility

HURRICANE WILMA LOCAL STATEMENT ADVISORY NUMBER 32 NATIONAL WEATHER SERVICE MIAMI FL AL242005 533 AM EDT SUN OCT 23 2005

THIS PRODUCT COVERS SOUTH FLORIDA

EXTENSIVE TO DEVASTATING DAMAGE AND LIFE-THREATENING CONDITIONS EXPECTED AS HURRICANE WILMA MOVES NORTHEAST ACROSS SOUTH FLORIDA

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SITUATION OVERVIEW

EXTREMELY DANGEROUS HURRICANE WILMA IS FORECAST TO IMPACT SOUTH FLORIDA BEGINNING THIS EVENING. THE MAIN CONCERN IS FOR LIFE-THREATENING INUNDATION IN SURGE-PRONE AREAS OF COLLIER AND MAINLAND MONROE COUNTIES WHERE THERE IS A SUBSTANTIAL RISK OF DEVASTATING IMPACTS SOMETIME BETWEEN EARLY MONDAY MORNING AND ADDITIONALLY, THERE IS A RISK FOR DEVASTATING DAMAGE FROM WIND ACROSS MAINLAND SOUTH FLORIDA PARTICULARLY DURING AYLIGHT HOURS MONDAY AS WILMA CROSSES THE PENINSULA.

THERE ARE ALSO CONCERNS WITH SIGNIFICANT IMPACTS FROM FLOODING RAINS AS THE HURRICANE MOVES ACROSS THE AREA LATE

ISOLATED TO SCATTERED TORNADOES CAPABLE OF INFLICTING LIMITED TO LOCALLY SIGNIFICANT DAMAGE ARE ALSO POSSIBLE STARTING THIS AFTERNOON AS OUTER RAIN BANDS BEGIN TO IMPACT SOUTH FLORIDA. OUTSIDE COMPLETING YOUR PREPARATIONS, STAY TUNED TO THE LATEST IN FORMATION IN CASE TORNADO WARNINGS BECOME NECESSAR'

SEVERAL COUNTIES HAVE MANDATORY EVACUATION ORDERS YOUR LOCAL COUNTY OFFICIALS FOR ORDERS WHICH MAY A FECT YOU.



Hurricane Local Statement

- Potential Impact Sections
 - Surge
 - Wind
 - Flooding Rain
 - Tornadoes



* SURGE:

PREPARE FOR LIFE-THREATENING STORM SURGE AND DEVASTATING DAMAGE IN SURGE PRONE AREAS OF SOUTH FLORIDA, WITH THE GREATEST IMPACTS ACROSS COASTAL SECTIONS OF COLLIER AND MAINLAND MONROE COUNTIES. IN THESE AREAS, POTENTIAL IMPACTS INCLUDE:

- WIDESPREAD DEEP INUNDATION, WITH STORM SURGE FLOODING GREATLY ACCENTUATED BY POWERFUL BATTERING WAVES. STRUCTURAL DAMAGE TO BUILDINGS, WITH MANY WASHING AWAY. DAMAGE GREATLY COMPOUNDED FROM CONSIDERABLE FLOATING DEBRIS. LOCATIONS MAY BE UNINHABITABLE FOR AN EXTENDED PERIOD.
- NEAR-SHORE ESCAPE ROUTES AND SECONDARY ROADS WASHED OUT OR SEVERELY FLOODED. FLOOD CONTROL SYSTEMS AND BARRIERS MAY BECOME STRESSED.
- EXTREME BEACH EROSION. NEW SHORELINE CUTS POSSIBLE.
- MASSIVE DAMAGE TO MARINAS, DOCKS, BOARDWALKS, AND PIERS.
 NUMEROUS SMALL CRAFT BROKEN AWAY FROM MOORINGS WITH MANY LIFTED
 ONSHORE AND STRANDED.

BRACE FOR LIFE-THREATENING STORM SURGE AND SIGNIFICANT TO EXTENSIVE DAMAGE AS FAR INLAND AS AREAS ALONG AND ADJACENT TO TAMIAMI TRAIL IN COLLIER COUNTY.

PREPARE FOR LIMITED DAMAGE ACROSS PORTIONS OF THE SOUTHEAST FLORIDA COASTINCLUDING AREAS ADJACENT TO THE NORTH END OF BISCAYNE BAY IN MIAMI DADE AND THE BARRIER ISLANDS OF BROWARD AND PALM BEACH COUNTIES.

* WIND:

PREPARE FOR DEVASTATING DAMAGE ACROSS PORTIONS OF MAINLAND SOUTH FLORIDA INCLUDING THE SOUTHWEST COAST, MOST OF THE INTERIOR AND LAKE OKEECHOBEE REGION, AND PORTIONS OF THE EAST COAST INCLUDING PALM BEACH COUNTY AND INLAND PORTIONS OF BROWARD. IN THESE AREAS, POTENTIAL IMPACTS INCLUDE:

- STRUCTURAL DAMAGE TO STURDY BUILDINGS WITH SOME EXPERIENCING
 COMPLETE ROOF AND WALL FAILURES. COMPLETE DESTRUCTION OF MOBILE
 HOMES. DAMAGE GREATLY ACCENTUATED BY LARGE AIRBORNE
 PROJECTILES. LOCATIONS MAY BE UNINHABITABLE FOR WEEKS OR MONTHS
- NUMEROUS LARGE TREES SNAPPED OR UPROOTED ALONG WITH FENCES AND ROADWAY SIGNS BLOWN OVER.
- MANY ROADS IMPASSIBLE FROM LARGE DEBRIS, AND MORE WITHIN URBAN OR HEAVILY WOODED PLACES. MANY BRIDGES, CAUSEWAYS, AND ACCESS ROUTES IMPASSIBLE.
- WIDESPREAD POWER AND COMMUNICATIONS OUTAGES.

PREPARE FOR EXTENSIVE DAMAGE ACROSS SOUTHEAST FLORIDA INCLUDING METRO BROWARD AND MIAMI-DADE COUNTIES.



Hurricane Liaison Team

Augment rapid communications at the national level



NWS Offices Train and Work with Core Partners







Questions?

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